## British Iron Ores.

*Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain.* Vol. xii., *Iron Ores* (*continued*). *Bedded Ores of the Lias, Oolites, and Later Formations in England.* By G. W. Lamplugh, C. B. Wedd, and J. Pringle. 1920. 12*s.* 6*d.* Vol. xiii., *Iron Ores* (*continued*). *Pre-Carboniferous and Carboniferous Bedded Ores of England and Wales.* By Sir A. Strahan, Dr. W: Gibson, T. C. Cantrill, Dr. R. L. Sherlock, and Henry Dewey. 1920. 7*s.* 6*d.* (His Majesty's Stationery Office.)

THESE two volumes complete the series of six volumes devoted to an account of the iron ores of Great Britain, which will probably form the most enduring monument of Sir Aubrey Strahan's tenure of the Directorship of the Geological Survey. We now need only an account of the iron ores of Ireland, which are far from being negligible, in order to complete our knowledge of the iron-ore resources of the British Isles; the iron industry of this country is deeply indebted to Sir Aubrey Strahan for the invaluable information which he has placed at its disposal in this series of reports. It cannot be suggested that the work has been done before its time; the last official account of British iron ores was issued so far back as 1856 to 1862, when Sir Roderick I. Murchison was Director of the Geological Survey, and this consisted for the most part of a collection of analyses of ores made under the direction of Dr. John Percy.

The best evidence of the care and accuracy with which these analyses were made under the instructions of "the father of British metallurgy" is to be found in the fact that they are still often quoted, and many of them are repeated even in the reports now under consideration. The whole character of the iron industry has, however, been radically transformed within the last sixty years, and ores that were then comparatively neglected are to-day of the highest importance, whilst those that were then being most actively worked are now almost abandoned. This is especially true of the ores to which the present two volumes refer; at that time the bedded ironstones of the Coal Measures formed the mainstay of the iron manufacture of England, whilst the ores of the Lias and of the later formations had scarcely been touched; to-day the great bulk of English iron is made from the latter ores, the Carboniferous iron ores being worked only on a very small scale for quite special purposes in a few districts.

The pre-Carboniferous bedded ironstones are not to-day of any great importance, but they have been fully and carefully described, and rightly so, for it is scarcely possible as yet to foresee what their economic importance may some day be. The authors might have pointed out with advantage the close correspondence between these ores and the ores that have formed the basis of an important industry in Normandy, the latter being also bedded deposits of Oolitic ores consisting essentially of siliceous carbonate of iron, occurring just below the Armorican grit of Ordovician age.

The chief interest in the iron ores of Carboniferous age will probably attach to the estimates of the quantity of such ore that may still remain. Sir Aubrey Strahan's estimate is close upon 7230 million tons; large as this figure is, it is no doubt far below the quantity that actually exists; but it is equally beyond doubt that it is far in excess of the quantity that will ever be wrought. In illustration of the former thesis, the ironstones of Northumberland and Durham may be referred to. The only figure that Sir Aubrey Strahan gives for these is 1,500,000 tons for Redesdale and district; these particular ores occur at various horizons in the Carboniferous Limestone series, and have been worked only at a few points where they happen to outcrop, as at Redesdale, Bellingham, Haltwhistle, etc. The yield of ironstone is stated by two different authorities to have been respectively 8470 and 9680 tons of ironstone per acre, so that the estimate of quantity here given corresponds to less than 200 acres. Yet these ores are known in places some miles apart; they accompany beds of coal that are notable for their persistence, and there is no reason whatever for assuming that the ironstones are an outcrop formation and do not continue in depth.

It is, therefore, quite possible that these ironstones may extend over many hundreds of square miles, and, if so, the estimate of the quantity of ore given in the report is but a minute fraction of the amount that actually exists in this area. Furthermore, the ironstones of the Coal Measures are altogether omitted from the calculation; yet these ironstones were actually worked, and a century ago gave rise to a quite important iron industry in the northern part of Durham and the adjoining parts of Northumberland, in many places, such as Waldridge Fell, Urpeth, Birtley, Wylam, Hedley, Tow Law, Bedlington, etc., covering an area of probably quite 200 square miles. Mr. William Cargill estimated the yield at Shotley Bridge to be 5324 tons per acre; this appears to have been one of the richest sections, and if, for

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the sake of illustration, it is assumed that the average contents were only 2500 tons per acre, the total quantity of this ore could be estimated at 320 million tons. Furthermore, there are no grounds for assuming that these ores are limited to the area above-mentioned; they may quite well underlie the entire coal-field. For these counties, therefore, it may be asserted without hesitation that the estimate in the report falls very far short of the truth. At the same time it may be said with equal certainty that very little, if any, of this ironstone is ever likely to be wrought, so that, however greatly Sir Aubrey Strahan may have under-estimated the quantity of ironstone that exists in this part of England, the error is of no practical importance whatever.

The chief practical interest attaches to the report on the ores of the Lias, Oolites, and later formations, for it is to these that the British ironmaster must look for his ore supplies in the future. The work has been done in a most thorough and painstaking fashion, and will no doubt remain the standard work of reference on this subject for many years to come. Most of the figures have already been given in the Summary of Progress of the Geological Survey for 1917, but it is greatly to be regretted that the present volume nowhere tabulates the results now arrived at, as has been done for the Carboniferous ores. The Summary above quoted gives as the total amount of reserves of these ores in England more or less developed 1765 million tons, and as the probable additional reserves 2093 millions, or a total of 3858 million tons. The present report gives figures that do not differ very greatly from these, except as regards the Northampton ore. Apparently the total quantity of this ore is now given as 2308 million tons to be gotten from the counties of Northampton, Lincoln and Rutland, exclusive, apparently, of possible reserves, whilst the Summary of Progress gave as the known reserves 1252 millions, and as the probable reserves 976 millions, or a total of 2228 million tons. The grand total now arrived at apparently amounts to 4154 million tons, so that without insisting on minute exactitude, which is obviously out of the question in such matters, the British ironmaster may take comfort in the thought that he has probably something like 4000 million tons of ore at his disposal, and it is interesting to note that about one-half of this is represented by the Northampton ironstone.

These figures are eminently satisfactory, and Sir Aubrey Strahan deserves sincere thanks for this contribution to our knowledge, as well as hearty congratulations on the conclusion of this excellent piece of work.

H. Louis.

## Physical and Inorganic Chemistry.

*Recent Advances in Physical and Inorganic Chemistry.* By Prof. A. W. Stewart. With an Introduction by Sir William Ramsay. Fourth edition. Pp. xvi + 286 + v plates. (London: Longmans, Green, and Co., 1920.) 18*s.* net.

The popularity of Prof. Stewart's book shows that it meets the requirements of certain kinds of readers. It can scarcely appeal to the serious student of physical and inorganic chemistry. A good deal of the material dealt with would not commonly be said to belong to either of the branches of chemistry indicated in the title. Much of it is pure physics, such as the long descriptions of X-rays and positive rays, and it is noteworthy that in just these cases good recent monographs by experts, not too large or beyond the capacity of students, are available. Would it not have been wiser to utilise this space for the description of some less accessible recent advances in inorganic or physical chemistry?

In other cases, notably in the account of the fixation of nitrogen, the author does not appear to have been very critical in his choice of material. A whole chapter is devoted to the permutites, which cannot be said to have any general interest, and have a restricted industrial application. With such matters as the production and utilisation of ozone not dealt with, one could well have spared such unimportant details as these.

The chapter on absorption spectra seems out of place, since it deals mainly with organic chemistry, and the general conclusions drawn from the mass of work described are lamentably vague. It may be that "one atom has the effect of stimulating another into a certain state of vibration, while other atoms have not this power," but the statement does not take us much further, and reminds one of the conclusion reached by many workers in this and allied fields a few years ago, that the effects were somehow due to "motions of the electrons." These vague generalisations are not of much service.

It is doubtful whether a whole chapter on artificial transmutation is wise in a book which can be intended only for students. So little which is certain can yet be said in this field that it would perhaps have been wiser to use the space for some more definite advance. After devoting a whole page to the "transmutation" experiments of Ramsay and Cameron, the author can only add that a careful repetition of the work led to negative results. The reviewer is also under the impression that Sir E. Rutherford has modified his views on "H-particles," and in any case this

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